ACCESSION #: 9606180578

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Point Beach Nuclear Plant, Unit 2 PAGE: 1 OF 6

DOCKET NUMBER: 05000301

TITLE: Reactor Trip Due to Spurious Closure of Turbine Stop

Valves

EVENT DATE: 05/18/96 LER #: 96-001-00 REPORT DATE: 06/14/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 90

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR

SECTION: 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Glenn Adams, Licensing Engineer TELEPHONE: (414) 221-4691

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: TG COMPONENT: PSV MANUFACTURER: STRLNG

REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1130 on May 18, 1996 PBNP Unit 2 experienced a spurious turbine trip and subsequent automatic reactor trip from 90% power. The turbine trip was initiated by closure of both turbine stop valves, as indicated by the first-out annunciation of "2-of-2 Turbine Stop Valves Closed". All reactor protection features operated as designed. Post-trip troubleshooting isolated the cause of the turbine trip to a spurious loss of pressure in the turbine high- pressure emergency-trip line of the Electro-Hydraulic Control (EHC) System, without a coincident Auto Stop Trip (AST) depressurization. Although there was no physical evidence of valve degradation, the EHC Emergency Trip Solenoid Valve (20ET) was identified as a likely component to have failed. The valve was removed and replaced with an identical component. The suspect valve will be subjected to testing and

further evaluation to replicate its failure mechanism, if possible. A 4-hour Emergency Notification System (ENS) notification was made in accordance with 10 CFR 50.72(b)(2)(ii). The NRC Resident Inspector was also notified.

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Event Description:

On May 18, 1996, with the Unit 2 reactor operating at 90 percent reactor power, a turbine trip initiated a Unit 2 reactor trip. The turbine trip's first-out annunciator was "2-of-2 Turbine Stop Valves Closed". Plant equipment response to the turbine trip and reactor trip was normal. The Auxiliary Feedwater System actuated as required when steam generator levels dropped to setpoint values. The Reactor Coolant System pressure remained above the actuation setpoint for safety injection.

Post-Trip reviews indicated that equipment operation was normal prior to the trip, and no maintenance, testing, or special operation of the related equipment was in progress at the time. Reactor Protection System and Turbine Control Systems were operating normally, and no testing or surveillance was in progress. The operators received no alarms (e.g. 20AST trip) prior to the stop valve trip; indicating that there had been no actual demand for a turbine trip. However, the 20AST alarms were received 524 milliseconds later as a result of the stop valve trip; causing a reactor trip, which caused a genuine turbine trip signal that dumped AST.

Because the first-out annunciator of the trip was the 2-of-2 turbine

stop valves closure, troubleshooting focused on those components that had the greatest likelihood of causing both turbine stop valves to close or indicate closed. The troubleshooting process evaluated and systematically eliminated failure mechanisms that would have required multiple undetected component failures.

The most probable cause of the event was a spurious operation of the EHC Emergency Trip Solenoid Valve (20ET) either mechanically or electrically. Failure of other components were either more unlikely, or would have been detectable in some manner. The 20ET valve was suspect because it had just been replaced during the Fall 1995 Unit 2 refueling outage with a new valve design.

The valve was removed and replaced with an identical component.

Component and System Description:

High-pressure steam enters the main turbine through two turbine stop valves and four governor valves. One turbine stop valve and two governor valves form a single assembly; the stop valve providing upstream isolation of the two governor valves. The turbine stop valves are designed to operate in the full open or full closed position, while the governor valves are controlled to throttle steam flow to the turbine.

Two control systems provide turbine control and trip functions; the Electro-Hydraulic Control (EHC) System, and the Auto Stop Oil System. These two systems interact to trip the main turbine under any of the

following conditions: (1) turbine overspeed; (2) generator electrical faults; (3) low condenser vacuum; (4) thrust bearing failure; (5) low lube oil pressure; (6) low auto stop oil pressure; (7) reactor trip; (8) manual turbine trip; (9) loss of electro-hydraulic (EH) power; (10) both steam generator feedwater pump breakers open; or (11) either steam line isolation valve leaves the full open position.

Those trips only applicable to the 20ET valve are listed on page 4.

The EHC system is common to all the turbine stop and governor valves of the Unit 2 turbine. This system combines a solid state controller with a high pressure fluid supply system. In general, the high pressure of the EHC fluid on the valve operating cylinders will keep the turbine stop and governor valves open. The design is inherently fail-safe in that a loss of hydraulic pressure will result in the closure of turbine stop and governor valves to shutdown the turbine.

This high-pressure portion of the EHC system is referred to as the "high-pressure emergency-trip line".

Figure "SIMPLIFIED SKETCH OF APPLICABLE SECTIONS OF THE EHC AND AUTO

STOP OIL SYSTEMS" omitted.

By design, the high-pressure emergency-trip line is common to both turbine stop valves and all four (4) governor valves. Several

different valves are provided to automatically dump the pressure in this line (or a portion of this line) to effect the closure of the turbine stop and/or governing valves. These valves include: (1) the Interface Valve, (2) the 20ET (Emergency Trip) Valve, and (3) the 20AG (Auxiliary Governor overspeed protection) Valves. Automatic or spurious actuation of any of these valves would cause some combination of turbine stop and governing valve closure. To a certain degree, check valves and orifices in the hydraulic lines are designed to preserve the integrity of the system such that an internal hydraulic leak or malfunction in any valve operator would be limited and not result in complete EHC system failure.

The Interface Valve and the EHC Emergency Trip Solenoid Valve (20ET) function similarly in that the opening of either valve will dump the high-pressure emergency trip line; resulting in the shutting of both turbine stop valves and governor valves. The Interface Valve is hydraulically actuated by a separate auto stop oil system. Auto stop oil pressure keeps the Interface Valve closed. If auto stop oil pressure is released due to mechanical overspeed, solenoid 20AST actuation, low vacuum, low lube oil, or thrust bearing wear trip, the Interface Valve will open and dump EH fluid; causing the turbine stop and governor valves to close. Alternatively, the high-pressure emergency trip line may be dumped when the 20ET solenoid valve trips directly from one of the following events:

(1) manual trip pushbuttons on panels 1/2C-03, or automatic trip signals from:

(2) generator or output transformer lockout relays,

(3) a main steamline isolation valve (MSIV) starts to shut,

(4) an A-Train reactor trip breaker opens,

(5) both MFPs trip, or

(6) 2/3 AST pressure switches are < 45psig (indicating that the auto stop oil trip has actuated).

The combined systems incorporate several redundancies to ensure that the turbine will trip when required. For example, the loss of pressure in the auto stop oil system will cause the EHC System to dump by two different means: (1) the Interface Valve will open when the auto stop oil pressure on the actuator drops, and (2) the 20ET valve will open when 2- of -3 auto stop oil pressure switches trip at the low pressure setpoint. 20ET has an energize-to-open design which improves system reliability in that a de-energize-to-open design would cause a turbine trip for any loss of power to the solenoid.

The Auxiliary Governor overspeed protection valves (20AG) are isolated from the high-pressure emergency-trip line by a check valve to ensure that their actuation only dumps the EHC fluid from the governor valves,

and would not cause the turbine stop valves to shut. Actuation of

any 20AG valve or any other single component in the EHC system should not result in both turbine stop valves tripping shut (the initiating event of this LER).

The Reactor Protection System ensures that a turbine trip initiates a reactor trip. A turbine trip is sensed by 2-of-3 signals from autostop oil pressure or 2-of-2 turbine stop valves closed. A turbine trip causes a direct reactor trip above approximately 50% power (Reactor Protection Permissive P9) and a controlled short-term release of steam to the condenser which removes sensible heat from the reactor coolant system and thereby avoids steam generator safety valve actuation.

Cause:

Post-Trip reviews indicated that equipment operation was normal prior to the trip, and that no significant maintenance, testing, or special operation capable of causing the trip was in progress. Therefore, personnel error was eliminated as a cause, and the evaluation focused on equipment failure.

Because the first-out annunciator of the trip was "2-of-2 Turbine Stop Valves Closure", the troubleshooting focused on those system controls and protective system components that had the greatest likelihood of causing simultaneous closure of both turbine stop valves. The troubleshooting process evaluated and systematically eliminated failure mechanisms that would have required multiple

undetected component failures.

The investigation focused on the two valves that each provide a single barrier to prevent dumping the EHC high-pressure emergency-trip line. These two valves are the Interface Valve and the 20ET valve. To spuriously fail without detection, the Interface Valve operating diaphragm would have had to have failed and external leakage would have been detectable. Upon physical examination, no degradation was noted. Upon startup, with the turbine latched for rollup, temperature and flow measurements verified that there was no internal through-leakage in the system. Solenoid valves 20AG-1 and -2 were tested to verify the integrity of the adjacent check valve. Therefore, the investigation ultimately led to the EHC Emergency Trip Solenoid Valve (20ET), which had just been replaced in the Fall of 1995 with a new valve design. The valve was examined and removed. Westinghouse and the new valve vendor were contacted to identify the operating history of this valve design. Neither the examination nor the vendor's experience with operational valves indicated a likelihood for this valve to spuriously fail to the open position. A spurious, undetected control signal to the solenoid or a spurious voltage would have had to have been applied to the solenoid to cause the valve to open. However, based on the lower probability of other failures, it was

determined that the spurious opening of this valve was a probable cause of the turbine trip that initiated the reactor trip.

Therefore, this valve was removed and replaced with an identical model. Electrical and mechanical testing of the suspect component will continue.

Corrective Action:

Extensive troubleshooting was performed. The operator and valve of the failed component (20ET) was examined in place, removed, and replaced with a valve of an identical model. Troubleshooters found no fluid leaks or other visible evidence of a loss of functionality. Electrical circuits to the 20ET solenoid were monitored for stray electrical signals. Upon startup, with the turbine latched for rollup, temperature and flow measurements verified that there was no internal through-leakage in the system. Solenoid valves 20AG-1 and -2 were tested to verify the integrity of the adjacent check valve. In addition, EHC oil sample analyses indicated no abnormalities in the hydraulic fluid.

Electrical testing is being planned for the control and power circuitry of the 20ET valve during the next Unit 2 shutdown. Various plant conditions will be simulated to identify any potential for generation of a control signal or power oscillation which could cause the solenoid to energize, and therefore open.

In addition, we are reviewing our data inputs to determine whether

additional data points for the plant computer would be helpful in analysis of any future trips of this nature.

Reportability:

This Licensee Event Report is being submitted in accordance with the requirements of 10 CFR 50.73 (a)(2)(iv) "any event or condition that resulted in a manual or automatic actuation of any engineered safety feature (ESF), including the reactor protection system (RPS)."

Safety Assessment:

The reactor protection system functioned as designed during this event. Auxiliary Feedwater responded automatically on a low-low steam generator level and there was no safety injection. The safety of the plant and the health and safety of the public and plant employees was not jeopardized.

Similar Occurrences:

LER 301/95-003-00 Reactor Trip Due to Turbine Generator Electrohydraulic EH) Oil Leak

Wisconsin

Electric

POWER COMPANY

231 W Michigan, PO Box 2046, Milwaukee, WI 53201-2046 (414) 221-2345

VPNPD-96-039

June 14, 1996

Document Control Desk

US NUCLEAR REGULATORY COMMISSION

Mail Station P1-137

Washington, DC 20555

Gentlemen:

DOCKET 50-301

LICENSEE EVENT REPORT 96-001

REACTOR TRIP DUE TO SPURIOUS CLOSURE OF TURBINE STOP VALVES POINT

BEACH NUCLEAR PLANT, UNIT 2

Enclosed is Licensee Event Report 96-001-00 for Point Beach Nuclear Plant, Unit 2. This report is provided in accordance with 10 CFR 50.73(a)(2)(iv), "any event or condition that resulted in manual or automatic actuation of any engineered safety feature (ESF), including the Reactor Protection System". This report describes an event where the spurious closure of both main steam stop valves caused a reactor trip from 90 percent power.

If you require additional information, please contact us.

Sincerely,

Bob Link

Vice President

Nuclear Power

GDA

Enclosure

cc: NRC Resident Inspector

NRC Regional Administrator

A subsidiary of Wisconsin Energy Corporation

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